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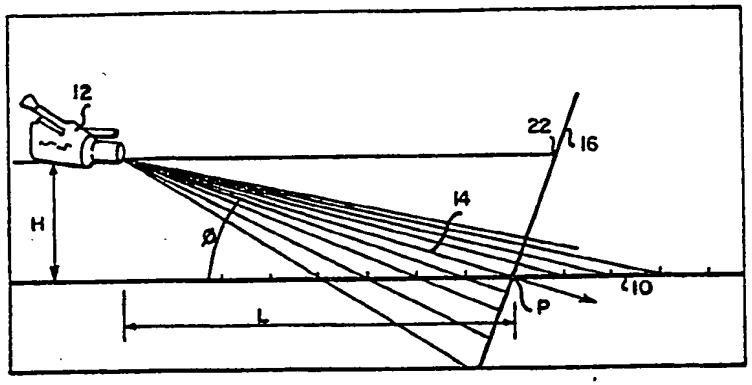

(57) Abstract

An image, e.g. of an advertising or promotional nature, is depicted in an inverse perspective form on a playing field (10) for a sporting event. The playing field is imaged by means of a video camera (12) whose line of sight (14) corresponds to the line of sight used in transforming the image to its inverse perspective form, and the output of the camera then broadcast or diffused in a television broadcasting or diffusion service.

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IMAGE CONVERSION

THIS INVENTION relates to the depiction of images. More particularly, but not exclusively, it relates to the depiction of images of an advertising or promotional nature, at sporting events.

According to one aspect of the invention there is provided a method of depicting an image, which includes applying an inverse perspective transformation of the image to a surface, and imaging the surface, with the transformed image depicted thereon, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.

The following is an explanation of what is meant by an inverse perspective transformation of an image. Images are often depicted on a surface in a perspective form. This gives an observer of the depiction the impression of depth. For example, lines that would, in three-dimensional space, be parallel to one another and extend away from the observer (ie would lie in a plane which forms a small angle with the observer's line of sight) are, in the depiction, represented as lines that converge towards a point referred to as the "vanishing point". The vanishing point lies on a horizontal line referred to as the "horizon". Likewise, points on anyone of these lines that would, in three-dimensional space, be spaced at equal intervals along the line are, in the depiction, represented as points which are spaced at intervals which become progressively smaller, the greater the distance of the points, in three-dimensional space, from the observer. The spacing between adjacent points tends to zero as the distance, in three-dimensional space, from the observer tends to infinity.

When viewing such a perspective depiction, the observer, by a process of visual or mental interpretation, visualises the converging lines as being parallel to one another in a plane extending away from the observer, and the points as being equi-distant from one another. This is so even though the surface on which the image is depicted may be at right angles to the line of sight of the observer.

By an inverse perspective transformation of an image, then, is meant a transformation of the image which is such that, when the transformed image is viewed by an observer from a position in which the line of sight of the observer intersects the surface to which the image is applied at a small angle, the observer, by a process of mental or visual interpretation, visualises the transformed image as extending in a plane extending at an angle (eg right angles) greater than said small angle to the line of sight of the observer.

The image may be of an advertising or promotional nature.

According to another aspect of the invention there is provided a method of depicting an image which is of an advertising or promotional nature, which includes applying an inverse perspective transformation of the image to a surface.

Where the surface is imaged, with the transformed image depicted on the surface, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form, the output of the camera may be broadcast or diffused in a television broadcasting or diffusion service.

The surface may be a playing surface or field for a sporting event.

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings.

In the drawings:

Figure 1 is a side view illustrating the principles of the invention;

Figure 2 illustrates a perspective grid and, superimposed thereon, a rectangular window in a focal plane extending at right angles to an observer's line of sight;

Figure 3 illustrates the window after inverse perspective transformation thereof; and

Figures 4a and 4b are diagrammatic side and plan views respectively, to show the symbols used in the mathematical equations used in the inverse perspective transformation of an image from a focal plane to a ground plane.

In Figure 1, reference numeral 10 designates a ground surface and reference numeral 12 a video camera whose line of sight 14 extends at a small angle ϕ to the ground surface. Reference numeral 16 designates an imaginary focal plane of the video camera, which extends at right angles to the line of sight 14, at a point P (the focal point) where the line of sight intersects the ground surface 10. The video camera 12 is positioned at a height H above the ground plane and at a horizontal distance L from the focal point P.

In Figure 2 line ABCD indicates a rectangular window in the focal plane 16, the window having the focal point P at its centre. The window ABCD is

superimposed on a perspective grid consisting of lines 18 and 20. The lines 18 and 20 represent lines that, in the ground plane 10, form a regular rectangular grid. The lines 18 thus converge to a vanishing point (not shown) on a horizontal line or "horizon" 22.

When the perspective grid illustrated in Figure 2 is transformed to a regular rectangular grid consisting of lines 18.1 and 20.1 as shown in Figure 3, and the same transformation applied to the rectangular window ABCD, the window ABCD becomes an elongated quadrilateral window having parallel sides BC and AD and diverging sides BA and CD. This transformation is herein referred to as an inverse perspective transformation. The same transformation can be applied to any design represented in the focal plane 16 in the window ABCD.

The transformation of co-ordinates in the focal plane 16 to co-ordinates in the ground plane 10 can be represented mathematically as follows, the various symbols that are used in the equations being shown in Figures 4a and 4b.

A point at BX, BY in the focal plane 16 corresponds to a point at GX, GY in the ground plane 10, such that:

$$GY = \frac{H}{\tan z} - L \qquad (1)$$

where

$$z = (\phi - \theta) \qquad (2)$$

$$\phi = \tan^{-1} \frac{H}{L} \qquad (3)$$

$$\theta = \tan^{-1} \frac{BY}{d} \qquad (4)$$

$$d = (H^2 + L^2)^{1/2} \quad (5)$$

if BY is positive, θ is positive

if BY is negative, θ is negative

if θ is positive, $z < \phi$

if θ is negative, $z > \phi$

if BY is positive, $\frac{H}{\tan z} > L$, GY positive

if BY is negative, $\frac{H}{\tan z} < L$, GY negative

and

$$GX = \frac{H}{\tan z} * \frac{BX}{L + n} \quad (6)$$

where

$$n = BY \cos j \quad (7)$$

$$j = (180° - z - g) \quad (8)$$

$$g = \sin^{-1} (GY \sin \frac{z}{BY}) \quad (9)$$

An image, which may be of an advertising or promotional nature, is transformed from focal plane co-ordinates to ground plane co-ordinates by an inverse perspective transformation as described above. It will be appreciated that this can readily be done by means of a computer. The transformed image is then applied to the ground surface 10.

Where the ground surface is a playing field for sporting events, the transformed image may be applied to the surface by means of chalk or the like marking material. TV coverage of the sporting event will cause the image to be displayed on the TV screen of every person watching the sporting event on TV. The observer will, by a process of mental or visual interpretation, visualise the image on his TV screen in

the form the image had prior to the inverse perspective transformation and the image will thus appear to be in a plane at right angles to the observer's line of vision. This will cause the image to stand out, increasing its impact on the TV audience.

CLAIMS:

1. A method of depicting an image, which includes applying an inverse perspective transformation of the image to a surface, and imaging the surface, with the transformed image depicted thereon, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.

2. A method as claimed in claim 1, wherein the image is of an advertising or promotional nature.

3. A method of depicting an image which is of an advertising or promotional nature, which includes applying an inverse perspective transformation of the image to a surface.

4. A method as claimed in claim 3, which further includes imaging the surface, with the transformed image depicted thereon, by means of a moving picture camera whose line of sight corresponds to the line of sight used in transforming the image to its inverse perspective form.

5. A method as claimed in any one of claims 1, 2, or 4, wherein the output of the camera is broadcast or diffused in a television broadcasting or diffusion service.

6. A method as claimed in any one of the preceding claims, wherein the surface is a playing surface or field for a sporting event.

7. A method of depicting an image, substantially as herein described and illustrated.

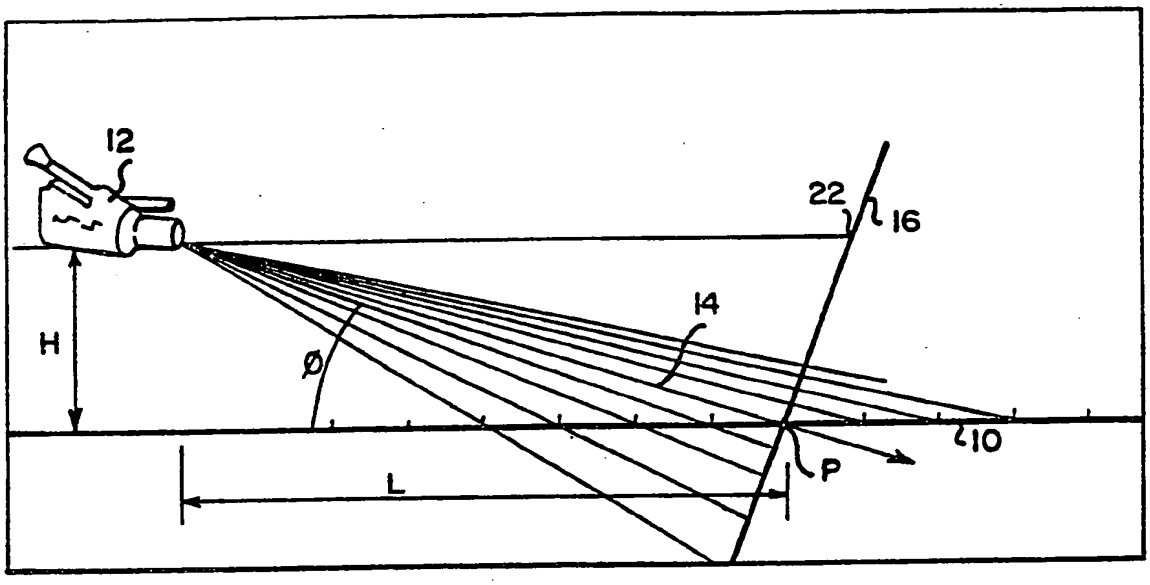

FIG. 1

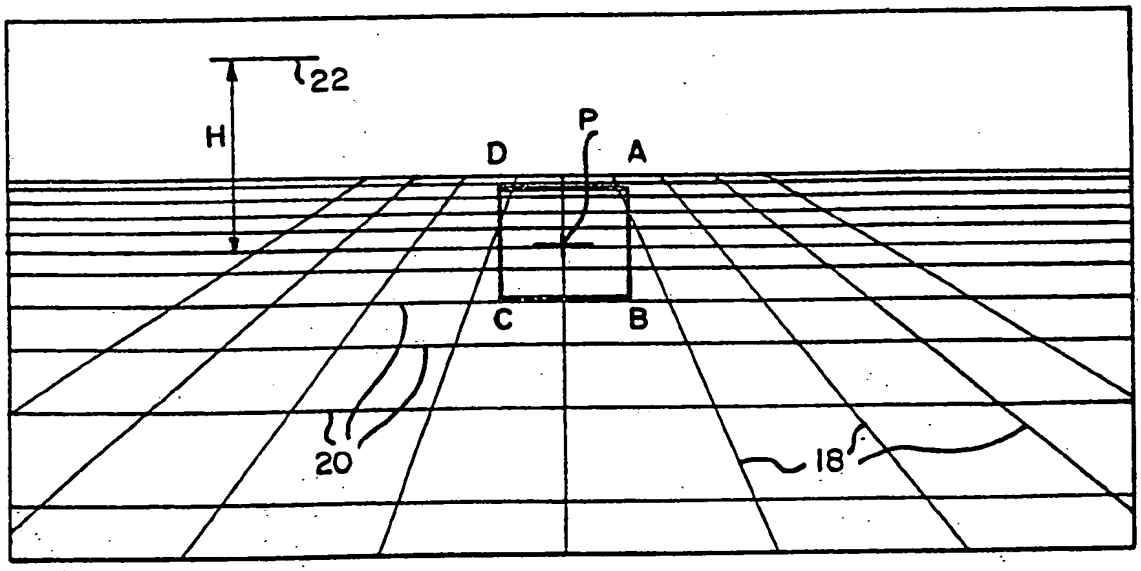

FIG. 2

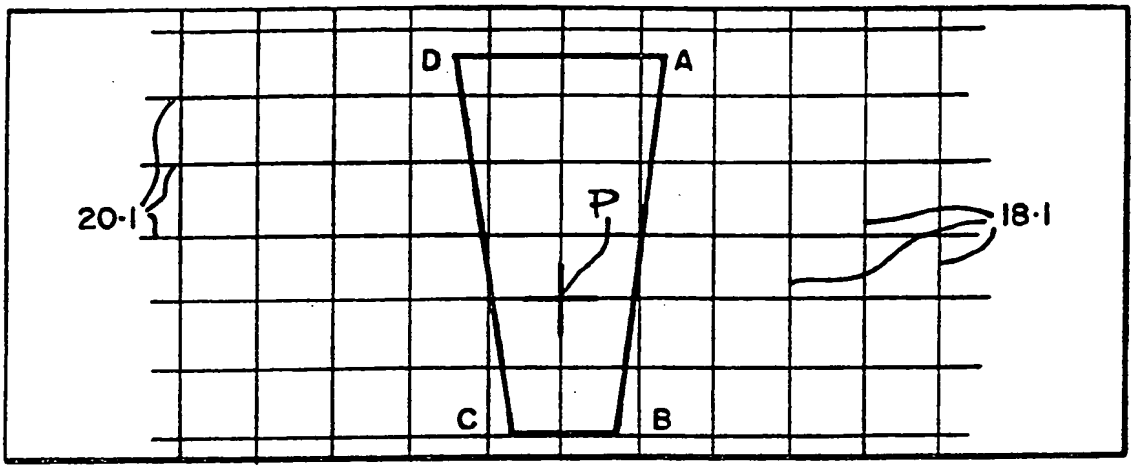

FIG.3

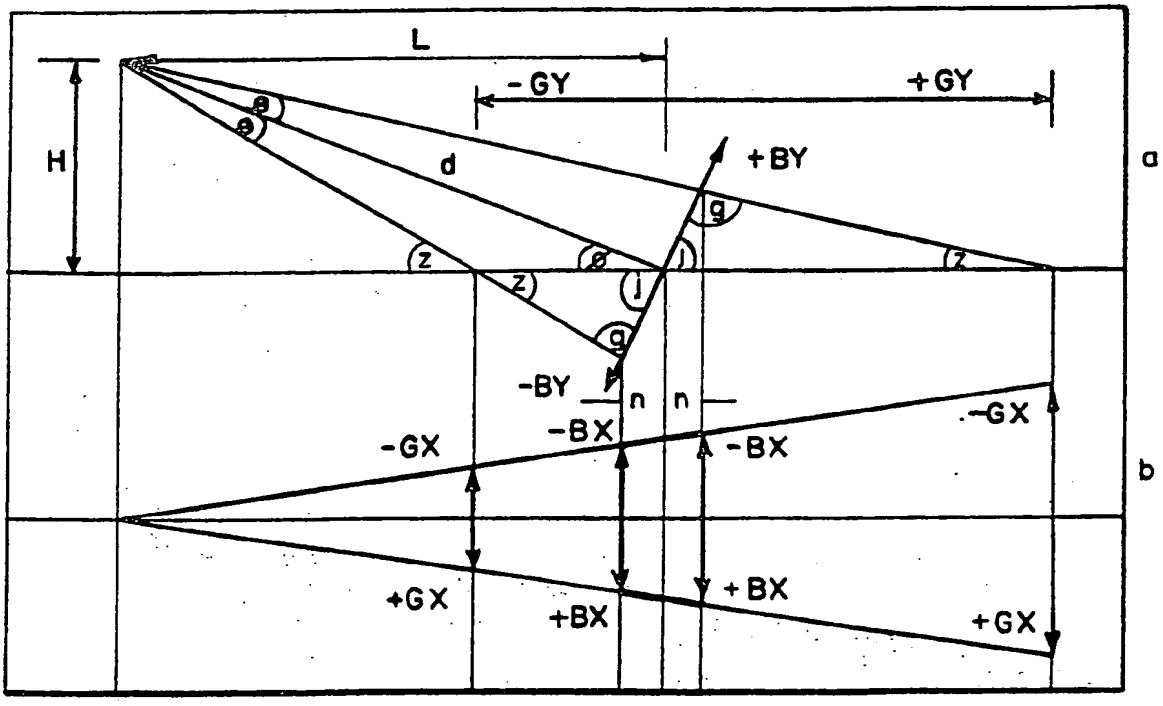

FIG.4

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/01538

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: H 04 N 5/262,G 06 F 15/72

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	H 04 N 5/00,G 06 F 15/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 4 956 706 (OHBA) 11 September 1990 (11.09.90), see abstract; fig. 1; column 4, lines 13-36; claim 1. --	1,3-5
Y	US, A, 4 667 236 (DRESDNER) 19 May 1987 (19.05.87), see abstract; column 2, lines 9-59; claim 3. --	1,3-5
A	US, A, 4\841 292 (ZENO) 20 June 1989 (20.06.89), see abstract; fig. 2.4,2.5; column 11, line 47 - column 12, line 16. --	1,5
A	EP, A2, 0 259 549 (IBM) 16 March 1988 (16.03.88),	1,5

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
23 November 1992	01 DEC 1992
International Searching Authority	**Signature of Authorized Officer**
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	see claims 1,3.	

ANHANG — ANNEX — ANNEXE

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

to the International Search Report to the International Patent Application No.

au rapport de recherche international relatif à la demande de brevet international n°

PCT/GB 92/01538 SAE 64370

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Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US A 4956706	11-09-90	DE A1 3920160	28-12-89
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		CA A1 1289675	24-09-91
		EP A3 259549	05-09-90
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